Air Quality Monitoring in the Cold Lake and Bonnyville Area
Interim Report: March 26 to 30, 2001

Summary

Alberta Environment is currently conducting a mobile, ambient air quality monitoring survey in the Cold Lake and Bonnyville area of Alberta. The study is ongoing and will consist of four weeklong surveys, over four seasons, for one year. The following results are for the spring survey.

The objectives of monitoring this area are:

(1) to address odour complaint issues,
(2) to determine concentrations of air pollutants representative of the monitored locations near facilities and residences in the survey area,
(3) to provide data to support air quality monitoring and modelling activities that have been conducted in the area, and
(4) to map the distribution of sulphur dioxide, nitrogen dioxide and ozone for the purpose of determining the need for a passive network.

Alberta Environment conducts mobile air quality surveys each year as part of its air quality monitoring program. These monitoring surveys are unannounced and use the department's *Mobile Air Monitoring Laboratory* (MAML). Pollutants measured by the MAML included sulphur dioxide, hydrogen sulphide, total reduced sulphur, hydrocarbons, particulates, ozone, oxides of nitrogen, carbon monoxide and ammonia.

During this spring survey, the mobile lab monitored air quality for five days at fifteen sites in the Cold Lake and Bonnyville area. Each site was monitored for two hours to allow comparison with Alberta's one-hour ambient air quality guidelines. This survey obtained close to 30 hours of air quality monitoring information. The sites were selected to provide data near populated areas and near industrial sites. Data for the same time period from five permanent monitoring stations in Alberta are also presented in this report. These are the Edmonton East and Fort Saskatchewan stations (operated by Alberta Environment), the Fort McMurray Athabasca Valley and Patricia McInnes stations (operated by the Wood Buffalo Environmental Association) and the Violet Grove station (operated by the West Central Airshed Society). This interim report presents the results of the spring 2001 survey (March 26 to 30, 2001). A final report will be issued after all monitoring is complete.

Major Findings

(1) Concentrations of air pollutants measured in the Cold Lake area survey were below Alberta's Ambient Air Quality Guidelines. Alberta has one-hour air quality guidelines for sulphur dioxide hydrogen sulphide, ozone, nitrogen dioxide, carbon monoxide and ammonia. Maximum one-hour concentrations were:

- 1% of the one-hour guideline for sulphur dioxide,
- 10% of the one-hour guideline for hydrogen sulphide,
- 57% of the one-hour guideline for ozone,
- 7% of the one-hour guideline for nitrogen dioxide,
- 7% of the one-hour guideline for carbon monoxide, and
- <1% of the one-hour guideline for ammonia.

(2) Hydrogen sulphide (H_2S) and sulphur dioxide (SO_2) concentrations were very low during the monitoring survey. The maximum one-hour concentrations for these two chemicals were 0.001 ppm (parts per million) and 0.002 ppm, respectively. The one-hour guideline is 0.010 ppm for H_2S and 0.172 ppm for SO_2.

(3) Higher than normal particulate levels caused by high winds and vehicle road dust were measured at Sites #10, #12, #14 and #15. The maximum one-hour total suspended particulate (TSP) concentration measured was 741 $\mu g/m^3$ (micrograms per cubic metre of air). This value occurred at Site #15 on March 30. Levels of PM_{10} (inhalable particulates) were 487 $\mu g/m^3$, and levels of $PM_{2.5}$ (respirable particulates) were 56 $\mu g/m^3$, at this location at this time. Normal rural concentrations of TSP, PM_{10} and $PM_{2.5}$ in Alberta are about 25, 15 and 5 $\mu g/m^3$, respectively. These levels will very depending wind speed, surface wetness and snow cover. Alberta does not have a one-hour guideline for particulate concentrations, although the 24-hour guideline for TSP is 100 $\mu g/m^3$ and the 24-hour Canada-wide Standard for $PM_{2.5}$ is 30 $\mu g/m^3$. Particulate levels measured during this survey were caused by wind-blown dust and road dust.

(4) Ozone (O_3) levels measured during the survey were similar to other locations in Alberta. The maximum one-hour ozone (O_3) concentration recorded in this survey was 0.047 ppm. Maximum one-hour ozone (O_3) concentrations over the same time period at other Alberta monitoring stations ranged from 0.046 ppm to 0.059 ppm. The one-hour guideline for O_3 is 0.082 ppm. Ozone is present in the background atmosphere due to natural processes. Some of these natural processes include transport from the "ozone rich" upper atmosphere and the reaction of naturally occurring organic chemicals and oxides of nitrogen in the presence of sunlight.

Alberta's Ambient Air Quality Guidelines

Alberta's Ambient Air Quality Guidelines[1] are established under Section 14 of the Environmental Protection and Enhancement Act (EPEA). EPEA provides for the development of guidelines and ambient environmental quality objectives for all or part of Alberta.

The Ambient Air Quality Guidelines are used in a number of ways:

- to report the state of the atmospheric environment in Alberta,
- to report the quality of air to Albertans through an air quality index,
- to establish approval conditions for regulated industrial facilities,
- to evaluate proposals to construct facilities that will have air emissions,
- to guide special ambient air quality surveys, and
- to assess compliance near major industrial air emission sources.

Air Quality Parameter	One-hour Guideline (ppm*)	Basis for Guideline
hydrogen sulphide	0.01	odour perception
ammonia	2	odour perception
carbon monoxide	13	oxygen carrying capacity of blood
nitrogen dioxide	0.212	odour perception
ozone	0.082	reduction of lung function and effects on tomatoes
sulphur dioxide	0.172	taste, odour perception and effects on bluegrass

[1] *Alberta Ambient Air Quality Guidelines.* Alberta Environment. February 2000.

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The MAML

The MAML is a 27-foot (8.2 m) vehicle that has been specially designed and equipped to measure air quality. It houses a variety of instruments that continuously sample the air at specified time or distance intervals.

The MAML is also equipped with:

- a dual computer system custom-programmed to control the measurement of air samples from each analyser,
- a Global Positioning System (GPS) that will identify the MAML's location as it moves around,
- an exhaust purifying system that minimises emissions from the vehicle, and
- two on-board generators that are also equipped with exhaust scrubbers.

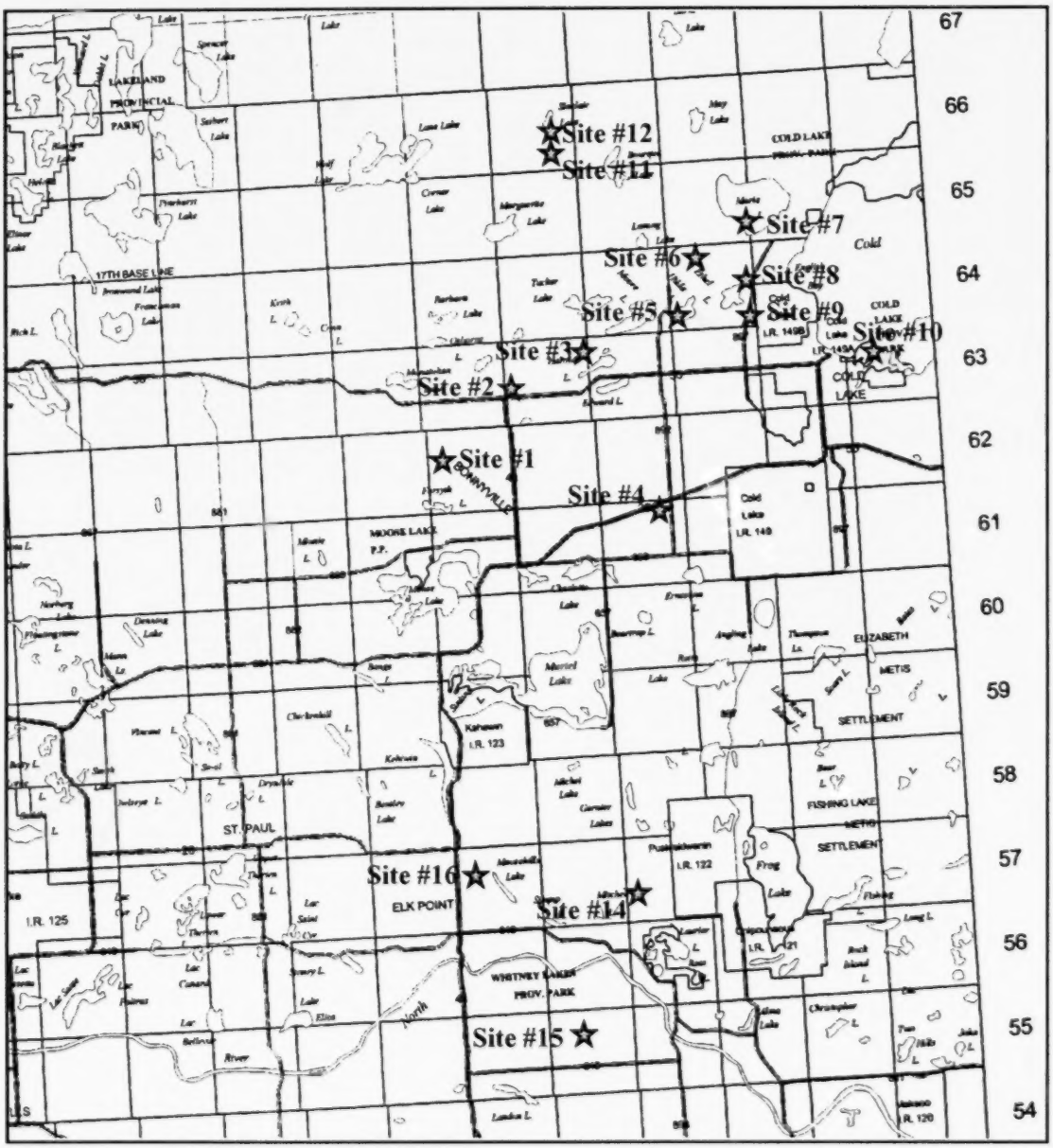
Monitoring Locations

The locations monitored were:

Site # 1 – 51 street and Lakeshore Drive (Town Centre-Bonnyville).
Site # 2 – La Corey Ranger Station (Hwy 41 & Hwy 55).
Site # 3 –AEC Trucking Terminal on Rge 455 (12-30-63-5 W4M).
Site # 4 – Old Suncor Site, 1 mile east and 2 miles south of Fort Kent (SE/SW 28-61-4 W4M).
Site # 5 – Hilda Lake (SW 6-64-3 W4M).
Site # 6 –Imperial Oil Landfill Site (8-33-64-3 W4M).
Site # 7 – Marie Lake (NE 1-65-3 W4M or SW 6-65-2 W4M).
Site # 8 – Ethel Lake (13-64-3 W4M).
Site # 9 – Cold Lake 1St Nations. (1-64-3 W4M).
Site #10 – Cold Lake Marina.
Site #11&12 – Sections 7, 8, 9, 10, 17-66-5 W4M (CNRL Wolf Lake & Primrose, 2 locations, one upwind and one downwind).
Site #14 – (4-18-57-4 W4M) Anadime Waste Management processors.
Site #15 – (14-28-55-5 W4M) CNR/Ranger CT.
Site #16 – (12-19-57-6 W4M) UPR Battery.

A map of these sites is on the next page.

Alberta Environment's Mobile Air Monitoring Laboratory *(MAML)*



Map of the Monitoring Sites in the Cold Lake and Bonnyville Area

Maximum One-hour Air Quality Parameter Concentrations in the Cold Lake/Bonnyville Area and at Other Alberta Locations (March 26 to 30, 2001)

Monitoring Location	CO	O_3	THC	CH_4	RHC	SO_2	NO	NO_2	NO_X	NH_3	TRS	H_2S	TSP	PM_{10}	$PM_{2.5}$	PAH
	(ppm)	(ppm)	(ppm)			(ppm)	(ppm)			(ppm)	(ppm)	(ppm)	(ug/m^3)			(ng/m^3)
Site # 1	0.7	0.031	no data			0.001	0.001	0.002	0.004	0.000	0.000	0.001	68	41	6	1
Site # 2	0.4	0.035	no data			0.001	0.001	0.001	0.003	0.000	0.000	0.000	19	13	3	0
Site # 3	0.5	0.039	no data			0.001	0.004	0.003	0.008	0.001	0.000	0.000	18	13	3	0
Site # 4	0.9	0.038	no data			0.001	0.002	0.002	0.005	0.000	0.000	0.000	20	13	2	2
Site # 5	0.2	0.040	no data			0.001	0.001	0.000	0.002	0.000	0.000	0.000	16	9	2	0
Site # 6	0.3	0.044	no data			0.000	0.002	0.001	0.003	0.001	0.000	0.000	74	43	6	5
Site # 7	0.2	0.044	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	18	9	1	0
Site # 8	0.3	0.045	no data			0.000	0.000	0.001	0.001	0.001	0.000	0.000	13	7	2	0
Site # 9	0.2	0.045	no data			0.000	0.001	0.001	0.001	0.000	0.000	0.000	21	13	2	0
Site # 10	0.9	0.042	no data			0.000	0.006	0.014	0.022	0.000	0.000	0.000	524	334	31	12
Site # 11	0.3	0.047	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	4	1	7
Site # 12	0.9	0.043	no data			0.002	0.003	0.006	0.009	0.004	0.001	0.001	305	162	13	2
Site # 14	0.3	0.038	no data			0.002	0.004	0.005	0.012	0.000	0.000	0.000	242	142	16	2
Site # 15	0.4	0.039	no data			0.002	0.007	0.006	0.015	0.000	0.000	0.000	741	487	56	4
Site # 16	0.3	0.042	no data			0.002	0.000	0.000	0.000	0.000	0.000	0.000	9	4	1	0
overall maximum	0.9	0.047	no data			0.002	0.007	0.014	0.022	0.004	0.001	0.001	741	487	56	12
Edmonton East	0.7	0.054	2.5	no data		0.012	0.051	0.039	0.090	no data		0.003	no data		18	no data
Ft. Saskatchewan	0.9	0.053	2.2	no data		0.003	0.030	0.034	0.064	0.006	no data	0.001	no data			
Athabasca Valley	0.6	0.046	2.1	no data		0.002	0.042	0.034	0.068	no data	0.001	no data			8	no data
Patricia McInnes	no data	0.049	2.4	no data		0.011	0.002	0.019	0.019	no data					16	no data
Violet Grove	no data	0.059	2.1	no data		0.003	0.002	0.006	0.008	no data						
one-hour guideline	**13.0**	**0.082**	**n/a**			**0.170**	**n/a**	**0.210**	**n/a**	**2.0**	**n/a**	**0.010**	**n/a**			

Edmonton East and Fort Saskatchewan are operated by Alberta Environment.

Athabasca Valley and Patricia McInnes are operated by the Wood Buffalo Environmental Association.

Violet Grove is operated by the West Central Airshed Society.

no data - Indicates that the analyzer was not operational for the indicated time period.

ng/m^3 - nanograms per cubic metre of air

ug/m^3 - micrograms per cubic metre of air

n/a No one hour guideline.

ppm - parts per million

One-hour Average Air Quality Parameter Concentrations at each Monitoring Site in the Cold Lake/Bonnyville Area (March 26 to 30, 2001)

Date	Monitoring Location	Time (MST)	CO	O_3	THC	CH_4	RHC	SO_2	NO	NO_2	NO_X	NH_3	TRS	H_2S	TSP	PM_{10}	$PM_{2.5}$	PAH
			(ppm)	(ppm)	(ppm)			(ppm)	(ppm)			(ppm)	(ppm)	(ppm)	(ug/m^3)			(ng/m^3)
26-Mar-01	Site # 1	(2:58 p.m. to 3:58 p.m.)	0.3	0.024	no data			0.001	0.001	0.002	0.004	0.000	0.000	0.001	68	41	6	1
	Site # 2	(4:42 p.m. to 5:42 p.m.)	0.2	0.024	no data			0.000	0.000	0.000	0.001	0.000	0.000	0.000	19	13	3	0
	Site # 3	(6:32 p.m. to 7:32 p.m.)	0.5	0.020	no data			0.001	0.004	0.003	0.008	0.001	0.000	0.000	18	13	3	0
27-Mar-01	Site # 5	(9:30 a.m. to 10:30 a.m.)	0.2	0.040	no data			0.001	0.001	0.000	0.002	0.000	0.000	0.000	16	9	2	0
	Site # 6	11:25 a.m. to 12:25 p.m.)	0.3	0.044	no data			0.000	0.000	0.000	0.002	0.000	0.000	0.000	74	43	6	5
	Site # 9	(1:35 p.m. to 2:35 p.m.)	0.2	0.045	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	14	7	1	0
	Site # 8	(2:50 p.m. to 3:50 p.m.)	0.3	0.045	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	3	1	0
	Site # 7	(4:12 p.m. to 5:12 p.m.)	0.2	0.044	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	8	4	1	0
	Site # 10	(5:47 p.m. to 6:47 p.m.)	0.9	0.029	no data			0.000	0.006	0.014	0.022	0.000	0.000	0.000	524	334	31	12
	Site # 4	(7:43 p.m. to 8:43 p.m.)	0.3	0.038	no data			0.000	0.000	0.001	0.001	0.000	0.000	0.000	11	7	1	2
28-Mar-01	Site # 1	(8:45 a.m. to 9:45 a.m.)	0.7	0.031	no data			0.001	0.001	0.001	0.002	0.000	0.000	0.000	34	23	3	0
	Site # 4	10:11 a.m. to 11:11 a.m.)	0.9	0.028	no data			0.001	0.002	0.002	0.005	0.000	0.000	0.000	20	13	2	0
	Site # 2	11:58 a.m. to 12:58 p.m.)	0.4	0.035	no data			0.001	0.001	0.001	0.003	0.000	0.000	0.000	12	9	2	0
	Site # 3	(1:06 p.m. to 2:06 p.m.)	0.4	0.039	no data			0.000	0.001	0.001	0.003	0.000	0.000	0.000	16	10	2	0
	Site # 12	(2:57 p.m. to 3:57 p.m.)	0.5	0.043	no data			0.001	0.001	0.002	0.004	0.000	0.000	0.000	143	83	7	1
	Site # 12	(3:58 p.m. to 4:57 p.m.)	0.9	0.039	no data			0.002	0.003	0.006	0.009	0.004	0.001	0.001	305	162	13	2
	Site # 11	(5:06 p.m. to 6:06 p.m.)	0.3	0.047	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	4	1	7
29-Mar-01	Site # 5	(8:46 a.m. to 9:46 a.m.)	0.1	0.040	no data			0.000	0.001	0.000	0.001	0.000	0.000	0.000	4	2	0	0
	Site # 6	10:09 a.m. to 11:09 a.m.)	0.1	0.041	no data			0.000	0.002	0.001	0.003	0.001	0.000	0.000	13	8	1	1
	Site # 9	11:45 a.m. to 12:45 p.m.)	0.1	0.042	no data			0.000	0.001	0.001	0.001	0.000	0.000	0.000	21	13	2	0
	Site # 8	(12:57 p.m. to 1:56 p.m.)	0.1	0.043	no data			0.000	0.000	0.001	0.001	0.001	0.000	0.000	13	7	2	0
	Site # 7	(2:10 p.m. to 3:10 p.m.)	0.1	0.044	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	18	9	1	0
	Site # 10	(3:32 p.m. to 4:32 p.m.)	0.1	0.042	no data			0.000	0.000	0.000	0.001	0.000	0.000	0.000	36	21	2	1
30-Mar-01	Site # 14	(9:24 a.m. to 10:23 a.m.)	0.3	0.038	no data			0.002	0.003	0.002	0.007	0.000	0.000	0.000	177	103	12	1
	Site # 14	10:24 a.m. to 11:25 a.m.)	0.3	0.037	no data			0.002	0.004	0.005	0.012	0.000	0.000	0.000	242	142	16	2
	Site # 16	12:07 p.m. to 1:06 p.m.)	0.2	0.041	no data			0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	4	1	0
	Site # 16	(1:07 p.m. to 2:08 p.m.)	0.3	0.042	no data			0.002	0.000	0.000	0.000	0.000	0.000	0.000	7	3	1	0
	Site # 15	(3:20 p.m. to 4:19 p.m.)	0.4	0.039	no data			0.002	0.004	0.003	0.008	0.000	0.000	0.000	705	432	50	2
	Site # 15	(4:20 p.m. to 5:21 p.m.)	0.4	0.036	no data			0.002	0.007	0.006	0.015	0.000	0.000	0.000	741	487	56	4
one-hour guideline			**13.0**	**0.082**	**n/a**			**0.170**	**n/a**	**0.210**	**n/a**	**2.0**	**n/a**	**0.010**	**n/a**			

no data - Indicates the analyzer was not operational for the indicated time period. n/a - No one hour guideline.

ng/m^3 - nanograms per cubic metre of air

ug/m^3 - micrograms per cubic metre of air

ppm - parts per million

List of Air Quality Parameters

CO - carbon monoxide
O_3 - ozone
THC - total hydrocarbons
CH_4 - methane
RHC - reactive hydrocarbons
SO_2 - sulphur dioxide
NO - nitric oxide
NO_2 - nitrogen dioxide
NO_X - total oxides of nitrogen
NH_3 - ammonia
TRS - total reduced sulphur
H_2S - hydrogen sulphide
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates
PM_{10} - inhalable particulates
$PM_{2.5}$ - respirable particulates